MAINTENANCE OF THE EPN ETRS89 COORDINATES / MAINTENANCE OF THE ETRS89 USING EPN

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EUREF TWG 2009 SPRING MEETING,
BUDAPEST 26-27 FEBRUARY 2009

STARTING POINT: EPN CUMULATIVE SOLUTION

- Created with CATREF / MC approach using the weekly combined EPN solutions,
- Solution details and ITRF2005 validation presented at the 2008 Fall TWG meeting,
- Regularly (3-4 / year) updated since 2002

DATUM DEFINITION

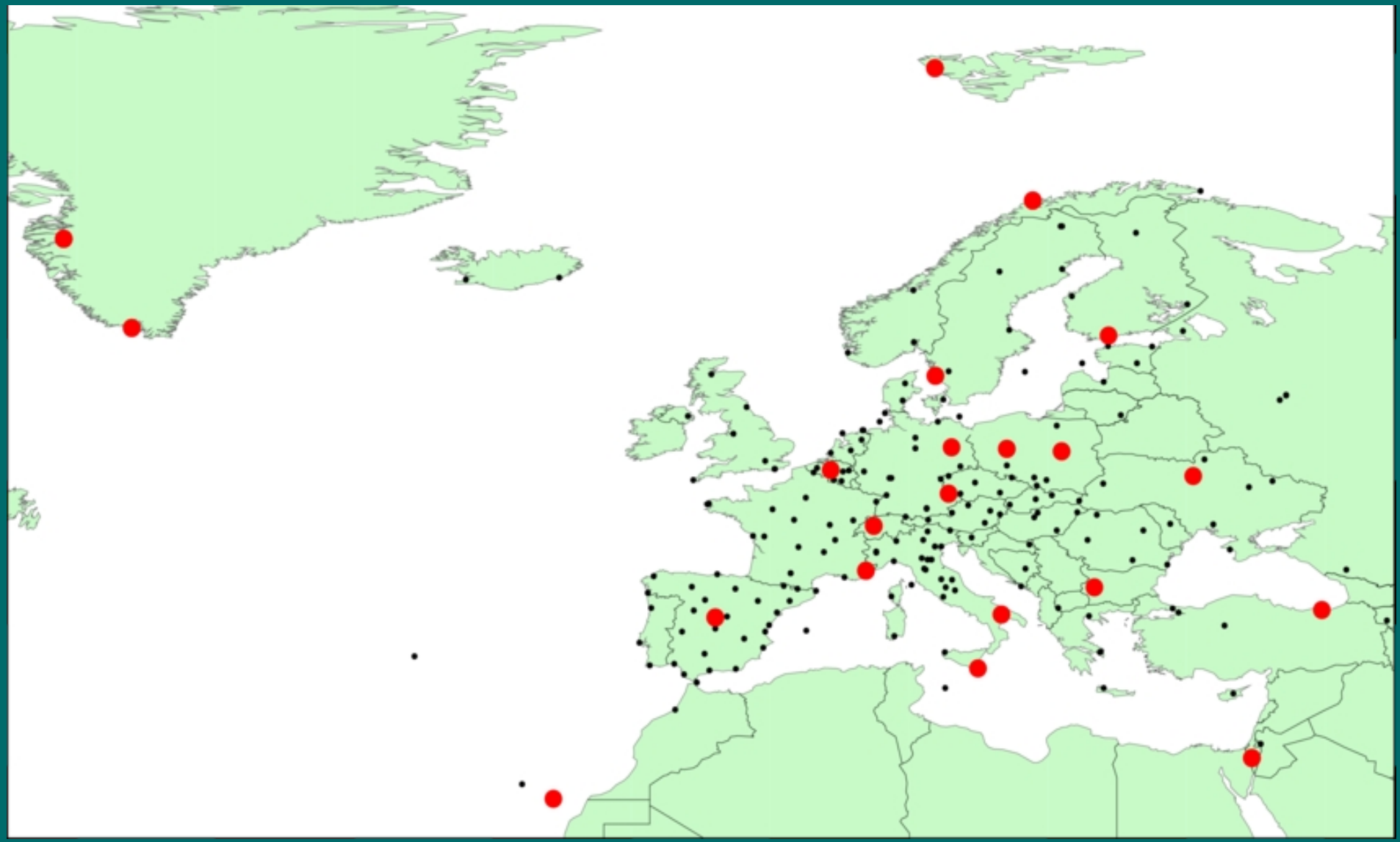
- Minimum Constraint
  - no direct constraints allowed, because of the site specific differences in ITRF/IGS and EPN
  - MC over 7 (TRS) parameters
- ITRF2005

  ITRF/IGS – EPN discontinuity table

  NOW full agreement with the log files
- Reference network selection

SELECTED REFERENCE NETWORK

22 SITES, 43 SOLUTION NUMBERS

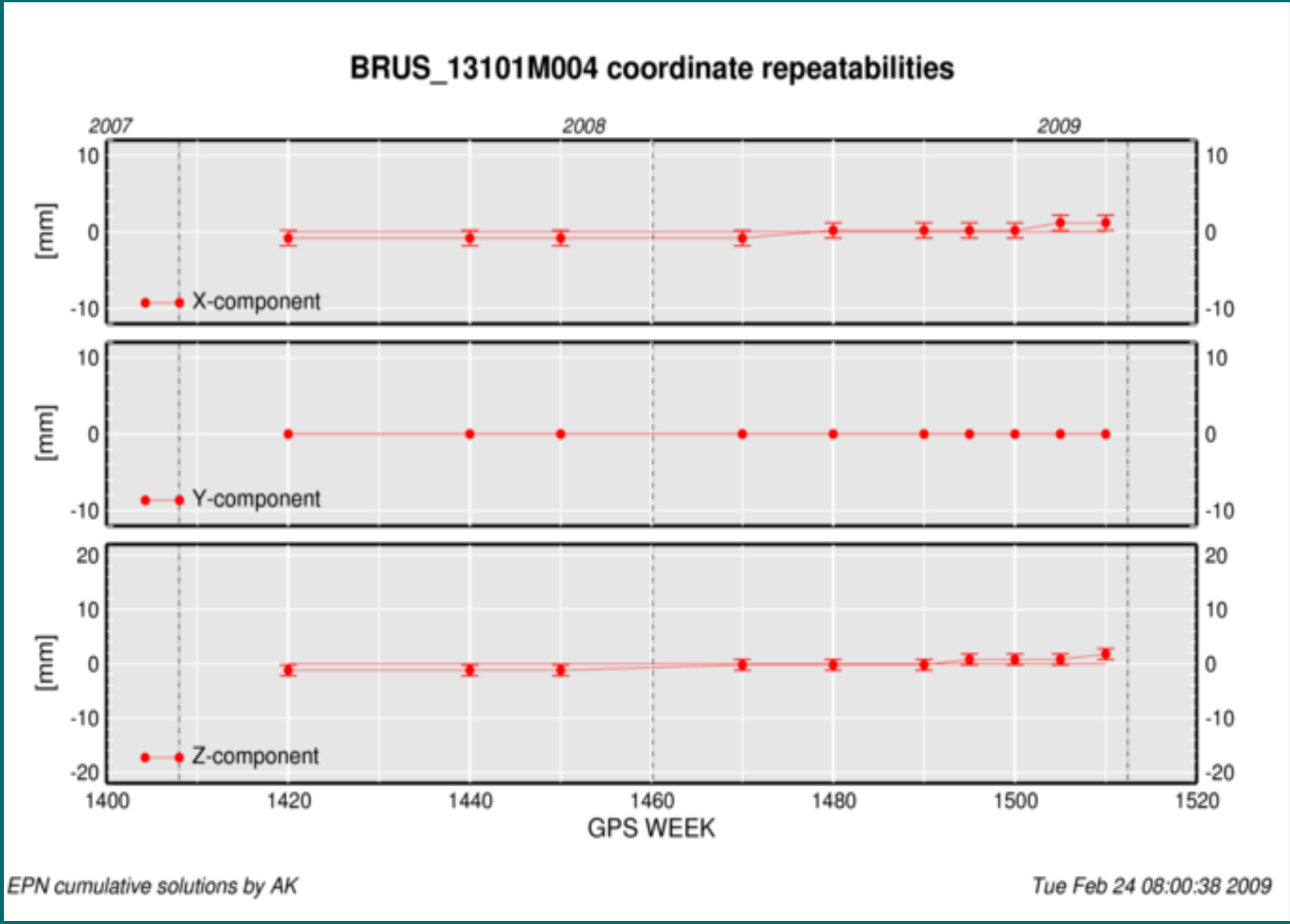


EPN CUMULATIVE SOLUTION

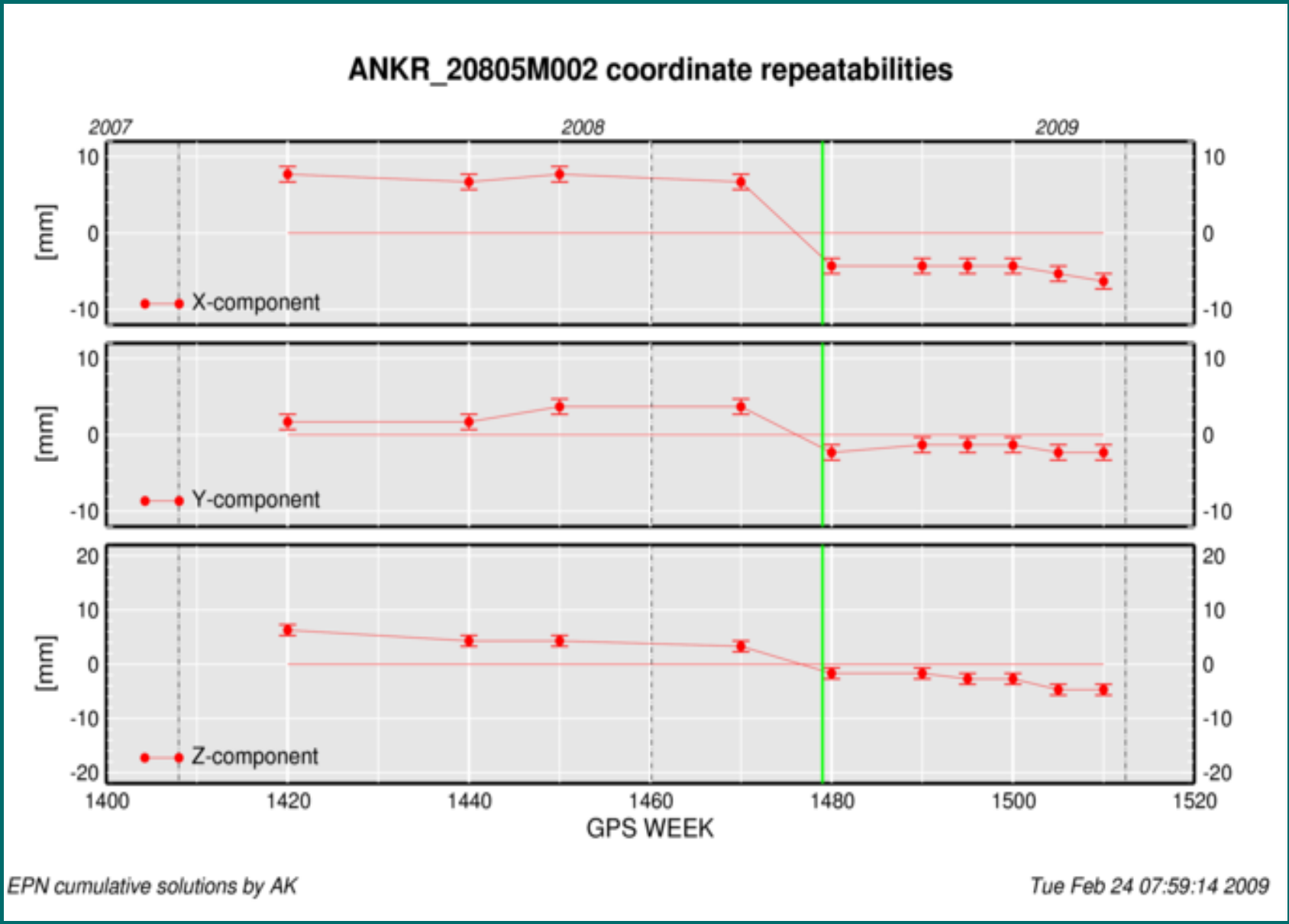
- Up-to-date CRD&VEL data in SINEX and SSC format
- Pre-defined single epoch for ALL stations

  all site coordinates are mapped from their mean epoch to the common epoch
- The younger a station, the bigger the epoch difference and the weaker the velocity value!
- Consequence: new stations show VERY high coordinate variation at the common epoch!

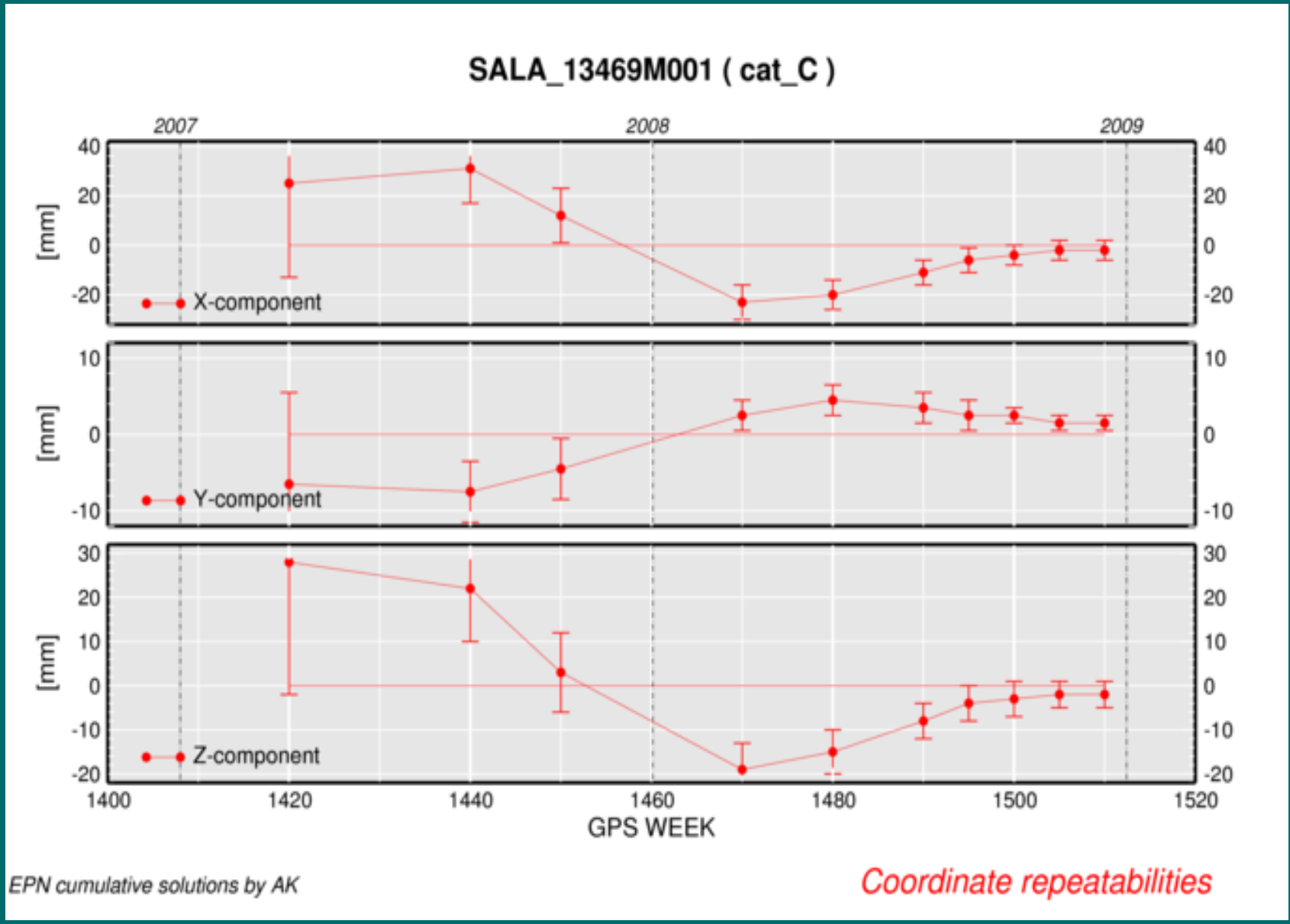
'OLD' STATION: BRUS



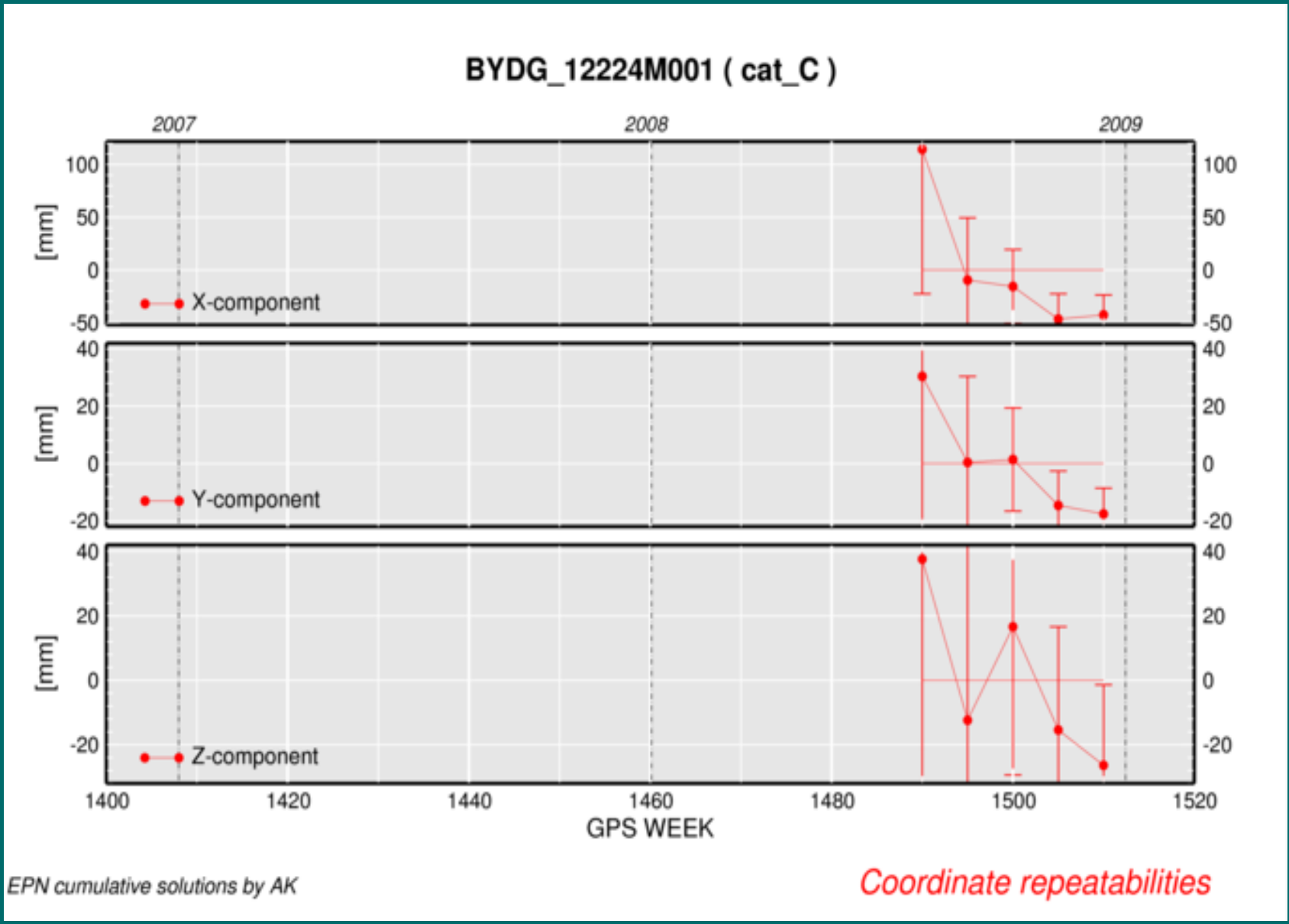
OFFSET: ANKR


ANKR_20805M002 coordinate repeatabilities
2007
2008
2009
[mm]
X-component
Y-component
Z-component
10
0
-10
20
-20
1400
1420
1440
1460
1480
1500
1520
GPS WEEK
EPN cumulative solutions by AK
Tue Feb 24 07:59:14 2009

'YOUNG' STATION: SALA



'VERY YOUNG' STATION: BYDG



EPN station categorization

STATIONS WITH SUFFICIENT LENGTH OF OBSERVATIONS AND HIGH QUALITY VELOCITIES SHOULD BE DISTINGUISHED FROM 'YOUNGER' SITES.

AS IN THE EUREF NETWORK:

CATEGORY A: 1 CM ACCURACY ETRS89 CRD AND 1 MM/YEAR VEL AT ANY EPOCH

CATEGORY B: 1 CM ACCURACY ETRS89 CRD (~~VEL~~) AT THE MEAN EPOCH

CATEGORIZATION TEST

TEST THE 'SUFFICIENT' LENGTH

1 / 2 / 3 OR MORE YEARS?

- INITIAL GUESS : 3 YEARS
- 1 YEARS : 10% OF THE STATIONS WERE OUT OF THE 1 CM COORDINATE LIMIT
- 2 YEARS : OK FOR ALL

Categorization in the practice

EPN_CWWWW.SNX - EPN cumulative SINEX

snx2ssc conversion tool

INTERNALLY

EPN_A_ITRF20yy_CWWWW.SSC / SNX		CRD & VEL
EPN_B_ITRF20yy_CWWWW.SSC	SNX?	CRD
EPN_A_ETRF2000_CWWWW.SSC / SNX		CRD & VEL
EPN_B_ETRF2000_CWWWW.SSC	SNX?	CRD

A – pre-defined single epoch (2000.0)

B – the actual mean epoch of each single station

SSC format (Set of Station Coordinates)

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          EPN ITRF2005 STATION POSITIONS (EPOCH 2000.0) AND VELOCITIES
                       CUMULATIVE SOLUTION OF GPSWEEKS [ 0860 - 1355 ]
                       CREATED BY THE EPN TIME SERIES SP USING CATREF

DOMES NB. SITE NAME        TECH. ID.       X/Vx          Y/Vy          Z/Vz          Sigmas        SOLN  DATA_START   DATA_END
                                                        ----------------------m/m/Y-------------------------
-------------------------------------------------------------------------------------------------------------------------------
13434M001 ACOR             GPS ACOR  4594489.746  -678367.887  4357066.065  0.001  0.000  0.001  1 99:248:00000 00:009:00000
13434M001                            -0.0100       0.0235       0.0107 0.0003 0.0001 0.0003
13434M001 ACOR             GPS ACOR  4594489.746  -678367.885  4357066.073  0.001  0.000  0.001  2 00:009:00000 02:209:00000
13434M001                            -0.0100       0.0235       0.0107 0.0003 0.0001 0.0003
13434M001 ACOR             GPS ACOR  4594489.736  -678367.883  4357066.059  0.001  0.000  0.001  3 02:209:00000 03:313:00000
13434M001                            -0.0100       0.0235       0.0107 0.0003 0.0001 0.0003
13434M001 ACOR             GPS ACOR  4594489.752  -678367.888  4357066.073  0.002  0.001  0.002  4 03:313:00000 06:309:00000
13434M001                            -0.0100       0.0235       0.0107 0.0003 0.0001 0.0003
10077M005 AJAC             GPS AJAC  4696989.506   723994.380  4239678.481  0.001  0.000  0.001  1 00:051:00000 06:309:00000
10077M005                            -0.0139       0.0189       0.0116 0.0001 0.0000 0.0001
13433M001 ALAC             GPS ALAC  5009051.241   -42072.294  3935057.669  0.001  0.000  0.000  1 99:248:00000 06:148:00000
13433M001                            -0.0104       0.0196       0.0129 0.0001 0.0000 0.0001
13437M001 ALME             GPS ALME  5105220.136  -219278.615  3804387.059  0.001  0.000  0.001  1 01:021:00000 06:309:00000
13437M001                            -0.0081       0.0186       0.0131 0.0002 0.0001 0.0001
20805M002 ANKR             GPS ANKR  4121948.562  2652187.938  4069023.702  0.001  0.000  0.001  1 96:210:00000 98:259:00000
20805M002                            -0.0078      -0.0042       0.0081 0.0001 0.0001 0.0001
20805M002 ANKR             GPS ANKR  4121948.578  2652187.929  4069023.724  0.001  0.000  0.001  4 99:316:61020 06:309:00000
20805M002                            -0.0078      -0.0042       0.0081 0.0001 0.0001 0.0001
12757M001 AQUI             GPS AQUI  4592507.656  1089876.271  4276392.929  0.001  0.000  0.001  1 01:287:00000 06:309:00000
12757M001                            -0.0174       0.0185       0.0126 0.0002 0.0001 0.0002
13431M001 BELL             GPS BELL  4775849.450   116814.272  4213018.902  0.001  0.000  0.001  1 99:031:00000 06:309:00000
13431M001                            -0.0105       0.0188       0.0127 0.0001 0.0000 0.0001
```

ETRS89 MAINTENANCE PROVE

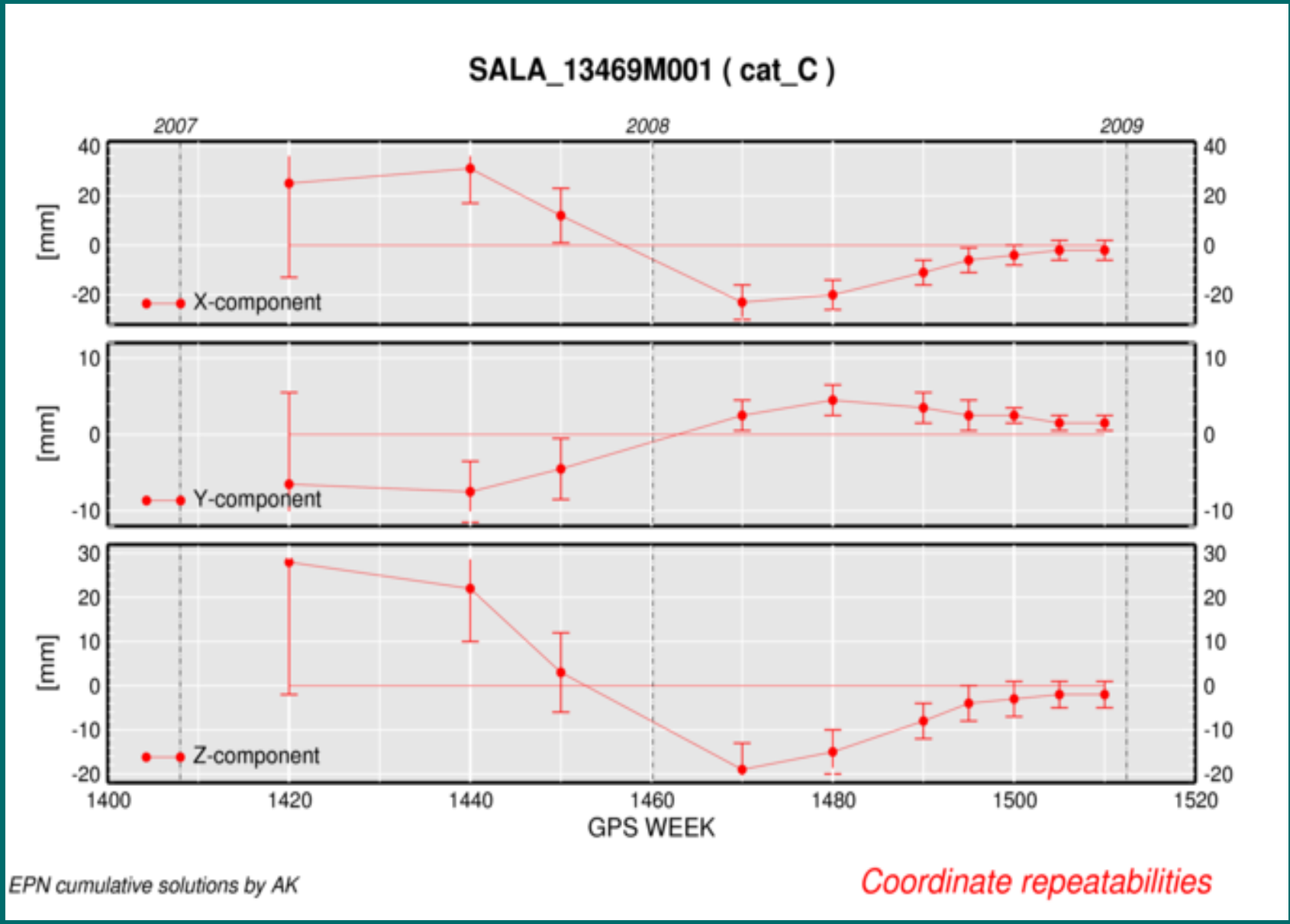
- SERIES OF CUMULATIVE SOLUTIONS HAS BEEN COMPUTED

  GPSWEEK 860-1420;-1440;-1460;-1480;-1490

  THEN UPDATES EACH 5 WEEKS !

- SAME DATUM DEFINITION AS USED FOR THE ITRF2005 DENSIFICATION
- THE SUBSEQUENT ETRF2000(R05) SSC SOLUTIONS WERE SPLITTED TO CATEGORIES A&B AND THE COORDINATE REPEATABILITIES WERE COMPUTED AND PLOTTED

'YOUNG' STATION: SALA



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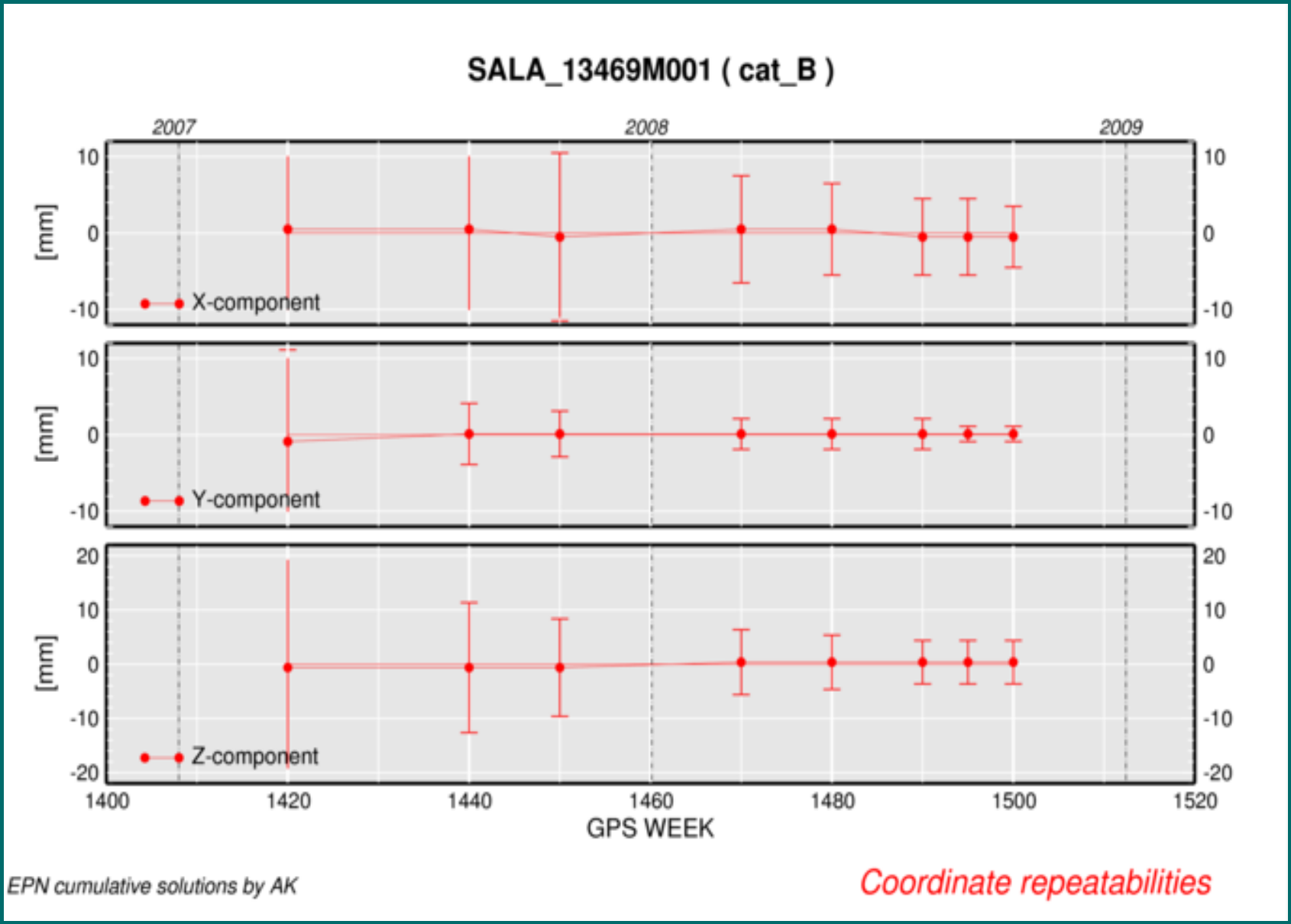

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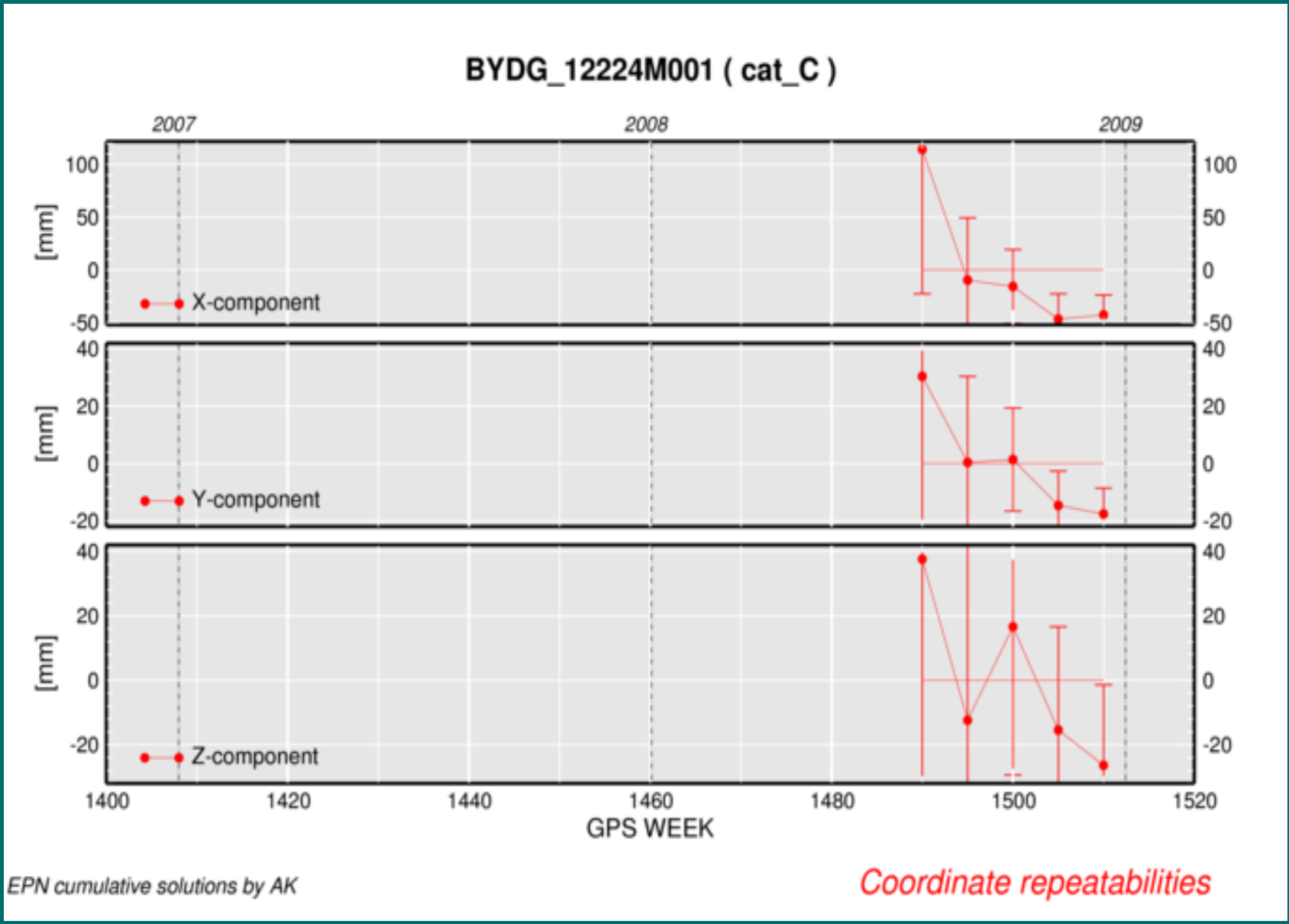
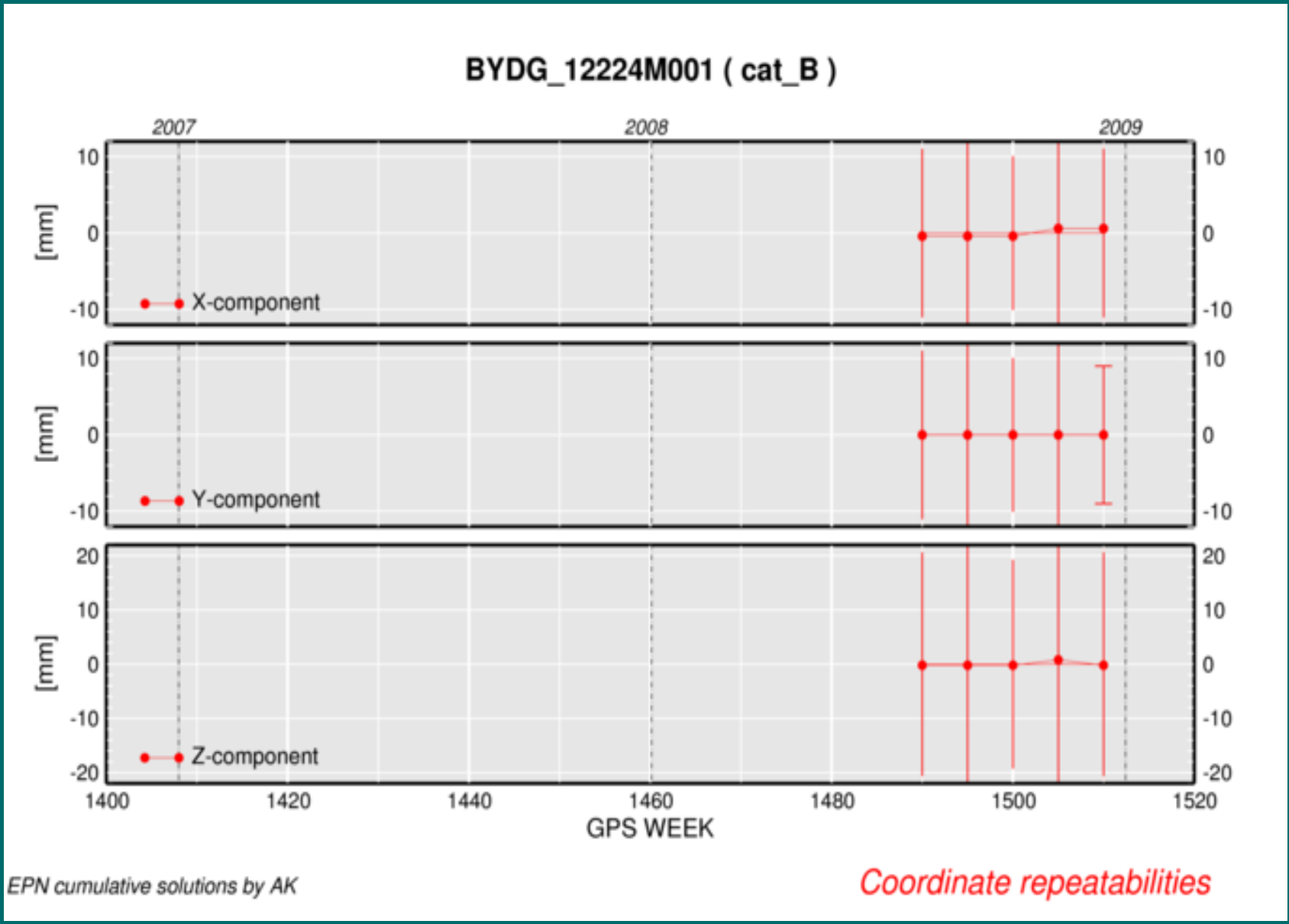
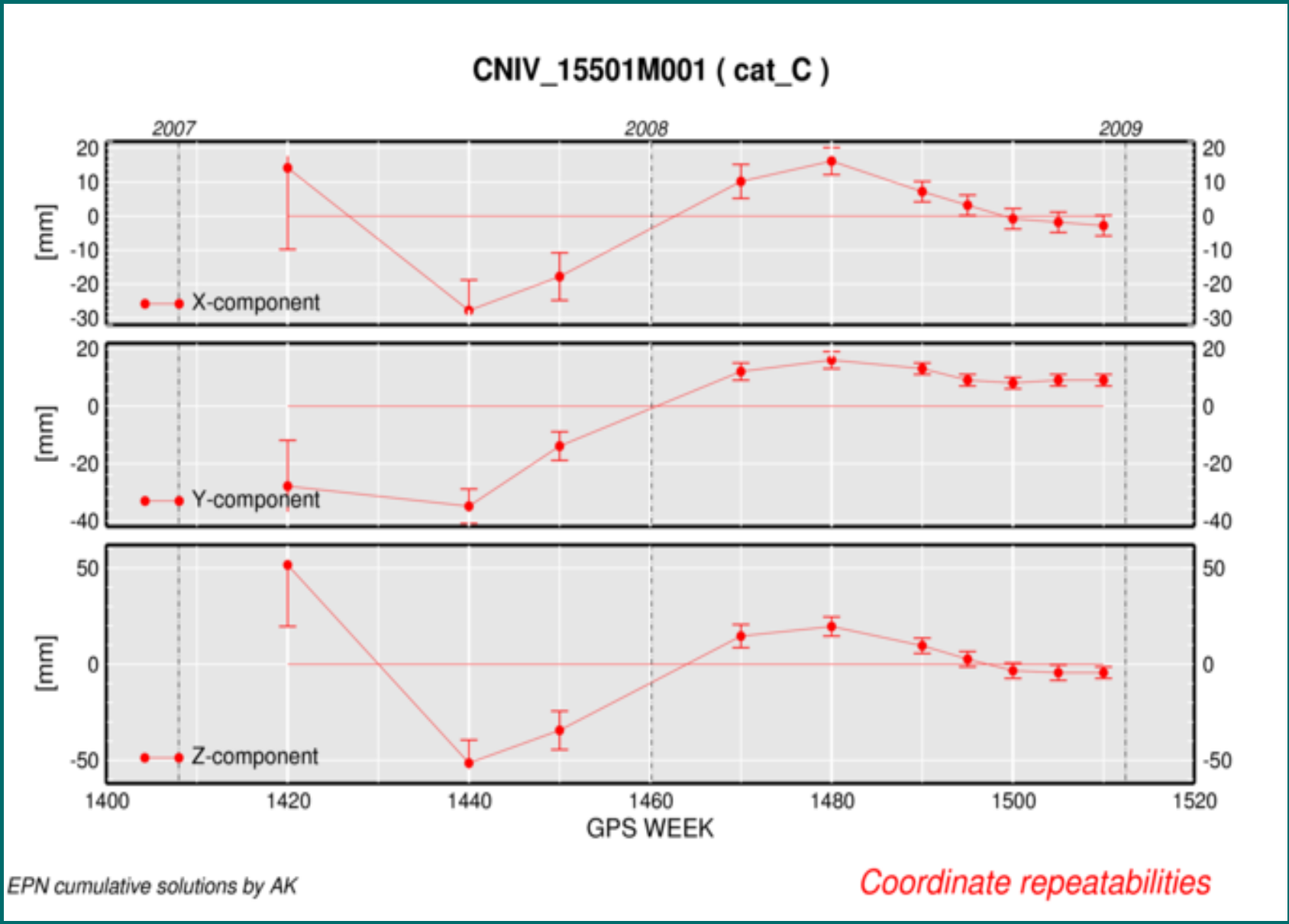


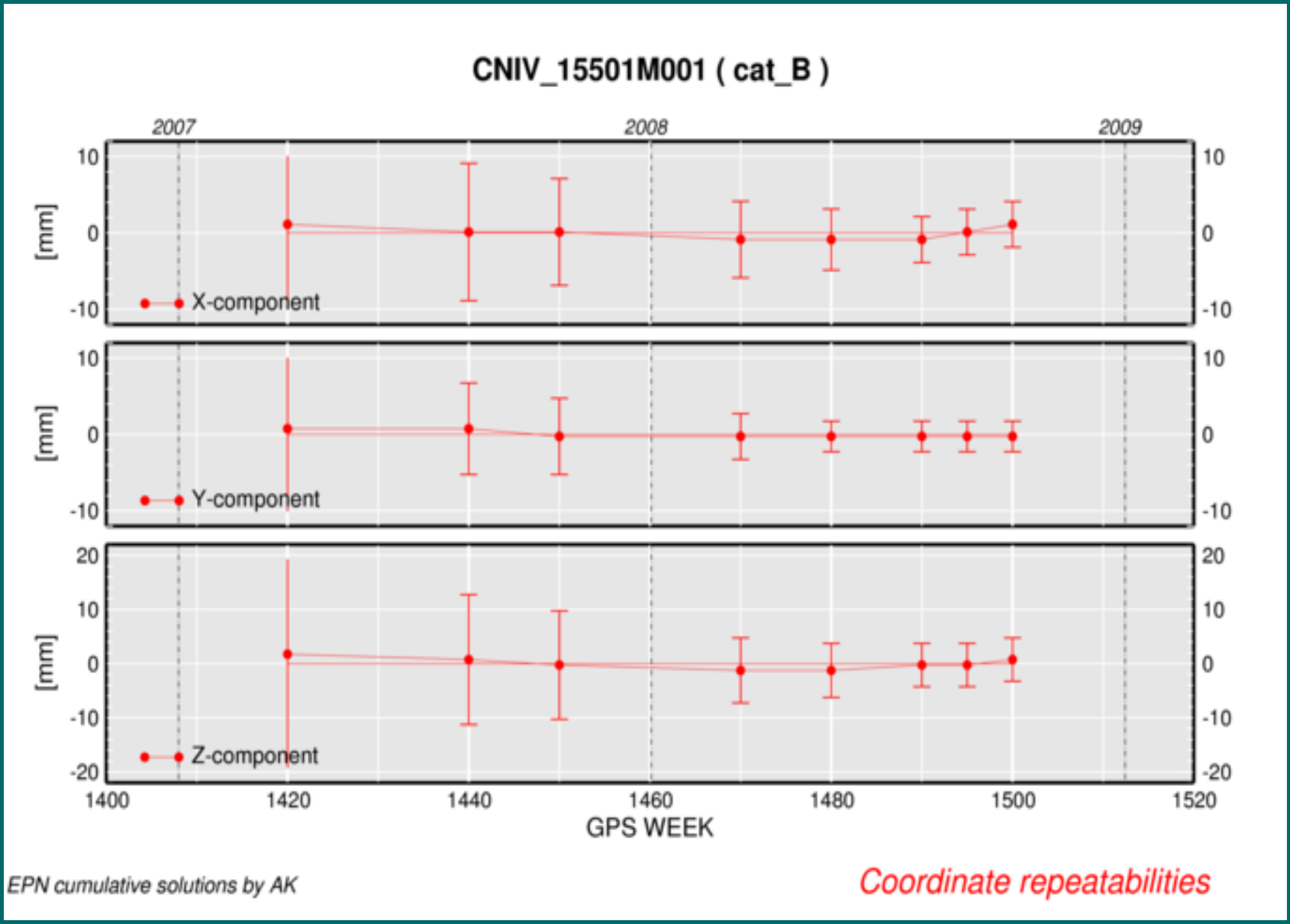
'VERY YOUNG' STATION: BYDG



SPECIAL CASE: CATEGORY TRANSITION



SPECIAL CASE: CATEGORY TRANSITION



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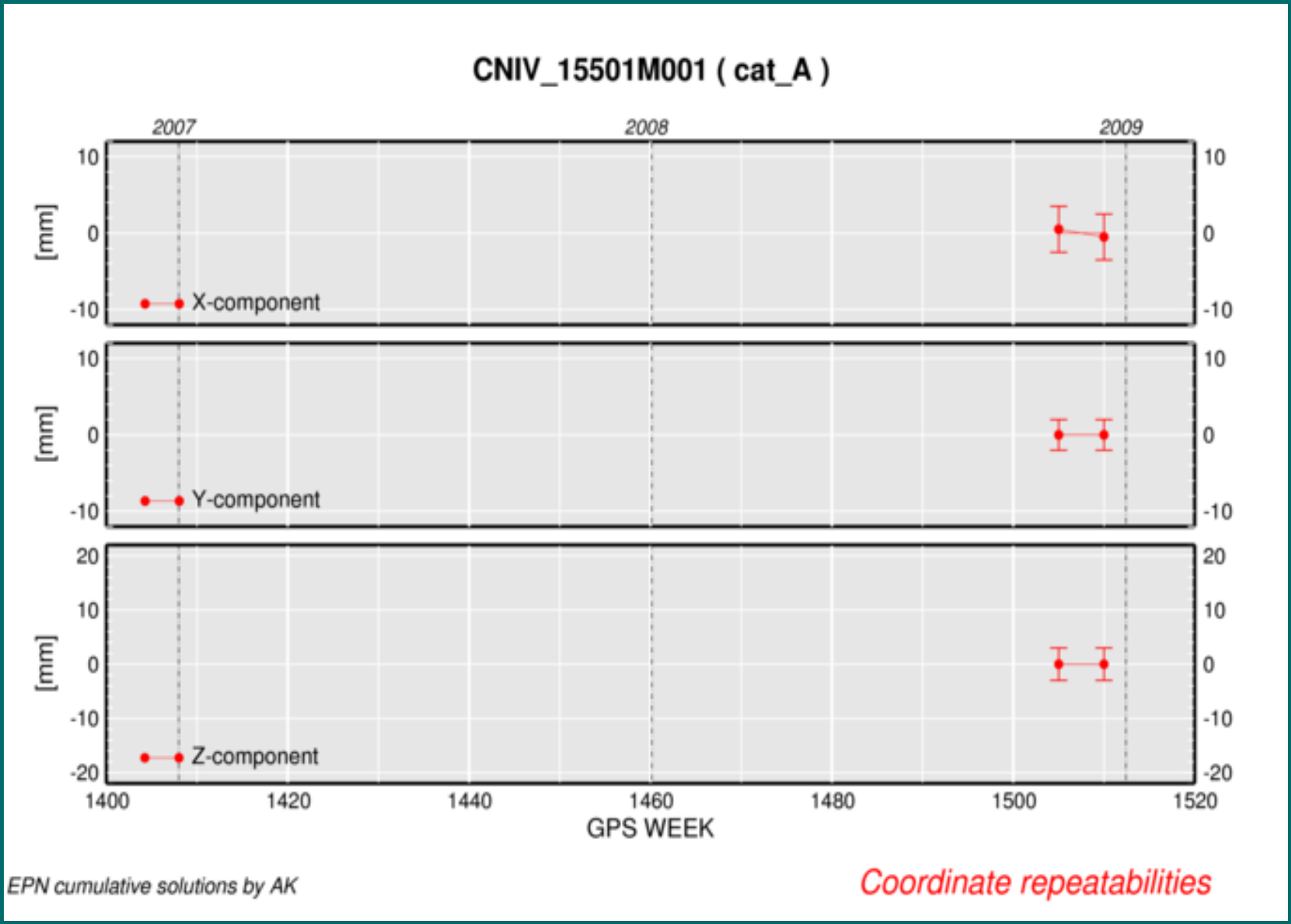

CONCLUSIONS

THE EPN CUMULATIVE SOLUTION IS CAPABLE TO MAINTAIN 1 CM ACCURACY ETRS89 COORDINATES FOR THE EPN SITES!

CONDITION: SITE CATEGORIZATION

cat_A – 1 cm CRD AT ANY EPOCH

1 mm/y VEL AT ANY EPOCH

cat_B – 1 cm CRD AT THE MEAN EPOCH

EPN ETRS89 MAINTENANCE

- A NEW CUMULATIVE SOLUTION IS COMPUTED EACH 5 WEEKS
- cat_A & B SNX AND SSC SOLUTIONS ARE PUBLISHED IN ITRFyy and ETRFyy
- NAMING CONVENTION:
  - INTERNAL EPN_A/B_ETRF2000_CWWWW
  - PUBLICATION EPN_A/B_ETRF2000
- THE HISTORICAL SOLUTIONS ARE ARCHIVED

EPN/ITRFyy SOLUTIONS

ITRS position/velocity table						
Name	Frame	Description	Usage	Expected Update	Published by	Published on
ITRF2005	ITRF2005	Long-term solution (??- Dec. 2005) based on GNSS, VLBI, SLR, and DORIS	EUREF densification campaigns/networks, relative antenna models	ITRF2008, end 2009	IERS	June 2006?
IGS05	ITRF2005	IGS stations included in ITRF2005 and corrected for the switch from relative to absolute antenna models	Absolute antenna models	---	IGS	Oct. 2006
EPN_ITRF2005_C1355	ITRF2005	Densification of the ITRF2005 using EPN data from GPS week 860 to 1355 (July 1996 - Dec. 2005)	EUREF densification campaigns/networks, relative antenna models	---	EUREF	Nov. 2008
EPN_A_ITRF20yy_Cwwww	**ITRF20yy**	**Regularly updated coordinate and velocity solution in ITRF20yy using EPN data from GPS week 860 to wwww. Only stations with more than 2 years of observation are included.**	**EUREF densification campaigns/networks, relative and absolute antenna models**	**EPN_A_ITRF20yy_Cwwww+5, each 5 weeks**	**EUREF**	**Feb. 2009 (wwww=1510) - now**
EPN_B_ITRF20yy_Cwwww	**ITRF20yy**	**Regularly updated coordinate solution in ITRF20yy using EPN data from GPS week 860 to wwww. Stations with less than 2 years of observation are included.**	**EUREF densification campaigns/networks, relative and absolute antenna models**	**EPN_B_ITRF20yy_Cwwww+5, each 5 weeks**	**EUREF**	**Feb. 2009 (wwww=1510) - now**

EPN/ETRF2000 SOLUTIONS

ETRS89 position/velocity table						
Name	Frame	Description	Usage	Expected Update	Published by	Published on
ETRF2000(R05)	ETRF2000	European stations included in ITRF2005 and converted to the ETRF2000	Relative antenna models	ETRF2000(R08), end 2009 (TBD)	EUREF	Oct. 2006
EPN_ETRF2000_C1355	ETRF2000	Densification of ETRF2000(R05) using EPN data from GPS week 860 to 1355 (July 1996 - Dec. 2005)	Relative antenna models	---	EUREF	Nov. 2008
EPN_A_ETRF2000_Cwwww	**ETRF2000**	**Regularly updated coordinate and velocity solution in ETRF2000 using EPN data from GPS week 860 to wwww. Only stations with more than 2 years of observation are included.**	**Relative and absolute antenna models**	**EPN_A_ETRF2000_Cwwww+5, each 5 weeks**	**EUREF**	**Feb. 2009 (wwww= 1510) - now**
EPN_B_ETRF2000_Cwwww	**ETRF2000**	**Regularly updated coordinate solution in ETRF2005 using EPN data from GPS week 860 to wwww. Stations with less than 2 years of observation are included.**	**Relative and absolute antenna models**	**EPN_B_ETRF2000_Cwwww+5, each 5 weeks**	**EUREF**	**Feb. 2009 (wwww= 1510) - now**